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Measuring E-Commerce Web Site Quality: An Empirical Examination

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ABSTRACT

Web sites are being widely deployed commercially; however, the factors that affect customer's perceptions on the quality and acceptance of a Web site are unclear. Through a literature review, this article examines and integrates four sets of factors that capture e-commerce Website quality: system quality, information quality, service quality, and attractiveness. Based on TAM, a framework is developed relating Web site quality to customers' beliefs (perceived usefulness and ease of use), attitudes (preferences for the site), and intentions (to revisit the site). A set of instruments of Web site quality has been developed and empirically validated by factor analysis. Guidelines for Web interface design are proposed for Web designers and managers.

Keywords

Web Site Quality; Technology Acceptance Model; IS success; Electronic Commerce.

INTRODUCTION

Web sites are being widely deployed commercially (Liu & Arnett, 2000; Robbins & Stylianou, 2003). Ample anecdotal evidence suggests the Internet is an effective tool for commercial purposes (Huizingh, 2000). However, just doing business on the Internet does not guarantee competitive advantages. E-commerce companies are dependent upon people visiting their sites, purchasing their products, and, more importantly, becoming repeat customers (Smith & Merchant, 2001). At the same time, customers have many Web sites that they can use as alternatives. There are almost no barriers to switching to other Web sites if performance is unacceptable (Bhatti, Bouch, & Kuchinsky, 2000). Consequently, in order to communicate with potential customers through the World Wide Web effectively, well-designed, high quality Web pages and Web sites are needed.

What constitutes Web site quality and the factors that affect customers' perceptions on the acceptance of the site are unclear (Lin & Lu, 2000; Dhyani, Ng, & Bhowmick, 2002). Pollard and Blyth (1999) discuss how it is often difficult to define what gives a Web site that extra something that keeps people coming back for more. As Hoffman and Novak (1995) note, little is known about how to develop commercial Web sites to maximize profit. Berthon, Pitt, & Watson (1996) call for research to reveal the true nature and effectiveness of electronic commerce (Huizingh, 2000).

Measures/metrics are the sine qua non of solid, scientific research (Straub *et al.*, 2002). Identifying and measuring the attributes of a quality Web site can thus enhance our understanding and advance our thinking to the state of science. The goal of this research is to identify those variables that lead to high quality Web sites. First, the literature on TAM and SERVQUAL is reviewed. Second, a framework is developed relating four essential factors of e-commerce Website quality to customers' perceptions, preferences, and intentions. Third, a set of instruments of Web quality is developed and empirically validated by a factor analysis. Finally, guidelines for Web interface design are proposed.

LITERATURE REVIEW

As e-commerce is a relatively new concept, no particular body of literature specifically addresses the concept of e-commerce Web site quality. However, design principles as well as metrics for predicting and/or evaluating effectiveness may be gleaned from two relatively well established areas of research. These areas address the technology acceptance model (TAM) and service quality (SERVQUAL).

Technology Acceptance Model

The technology acceptance model (TAM) of Davis (1989) is widely cited as a means for predicting system acceptance and for diagnosing design problems before users experience the system. TAM predicts that user acceptance of any system is determined by two factors: (1) perceived usefulness and (2) perceived ease of use. Perceived usefulness is defined as the degree to which a person believes that use of the system will enhance his or her performance. Perceived ease of use is defined as the degree to which a person believes that use of the system will be free from difficulty.

Since Davis's introduction of TAM, numerous researchers have discovered that TAM consistently explains much of the variance in why users use/accept systems. TAM is an adaptation of theory of reasoned action (TRA) specifically tailored for modeling user acceptance of IS. It is intended to provide an explanation of the determinants of computer acceptance. In addition, TAM is intended to be capable of explaining user behavior across a range of end-user computing technologies while at the same time being parsimonious and theoretically justified. Therefore, TAM should be applicable to the study of user acceptance of e-commerce Web sites because these constitute a class of IT projects. In fact, studies involving the application of TAM theory, along with its refinements/extensions to Web site acceptance, are accumulating (Eighmey & McCord, 1998; Liu & Arnett, 2000; Mathieson *et al.*, 2001).

Service Quality (SERVQUAL)

Among the various studies addressing IS success factors, those involving the dimensions suggested by Delone & McLean (1992) have received the most attention. Having surveyed 180 articles, Delone and McLean (1992) proposed six major dimensions of IS success: systems quality, information quality, use, user satisfaction, individual impact, and organizational impact. However, these six dimensions seem to include only the system aspect of IS success and overlook the human interaction aspect (Li, 1997). This deficiency can be overcome by the addition of the factors of service quality.

Service Quality is commonly defined as how well a delivered service level matches customer expectations (Parasuraman *et al.*, 1985). Parasuraman *et al.* (1985) identified 10 dimensions of service quality, and these dimensions were subsequently consolidated into five (*i.e.*, reliability, responsiveness, assurance, empathy, and tangibles), which now comprise the SERVQUAL instrument (Parasuraman *et al.*, 1988). Numerous other researchers now agree that service quality measures should be part of IS success assessment (Kettinger & Lee, 1995; Li, 1997; Delone & McLean, 2003).

Van Dyke *et al.* (1997) however question the application of SERVQUAL to IS service quality. Issues include the use of difference scores to measure the expectation gap, the unstable dimensionality of the SERVQUAL factors, and the difficulty of using a single instrument across industries. It is suggested that, in terms of its psychometric characteristics, an instrument for service perception is better than that for the difference score of the perception-minus-expectation. Van Dyke *et al.* conclude that it is preferable to use a perceptions-only method.

The SERVQUAL instrument has been tested in IS contexts (Kettinger & Lee, 1995; Pitt *et al.*, 1995). The dimension of tangibles addresses up-to-date hardware and software, reliability focuses on dependability, responsiveness measures the promptness of the service to users, assurance addresses the knowledge to do the job well, and empathy considers whether IS has users' best interest at heart. Since service quality overlaps systems quality, in the e-commerce context, service quality can be considered to cover assurance, reliability, and empathy, while systems quality addresses tangibles and responsiveness. Under e-commerce context, the reliability dimension of SERVQUAL can also be explained/replaced by the critical concept of trust. Trust is crucial in the transactional, buyer-seller relationships of customers and e-vendor because of the risk and uncertainty of the online environment (Reichheld & Schefter, 2000; Mayer *et al.*, 1995). Trust is an expectation that the e-vendor will not behave opportunistically by taking advantage of the situation (Gefen *et al.*, 2003). It is customers' beliefs that the e-vendors will behave in a reliable/dependable, ethical, and socially appropriate manner (Hosmer, 1995; Zucker, 1986).

Trust is defined as the subjective probability that customers believe that an organization's underlying technology infrastructure and control mechanisms are capable of supporting transactions (Pavlou, 2001). Pavlou (2001) holds that the digital economy encourages the creation of institutional provisions to support and guarantee transactions among entities that lack the traditional face-to-face context. There are many structural, trust-building assurances provided by the vendor, such as certification, HTTPS, guarantees, agreements, and policies. Such trust provides favorable impersonal conditions conducive to transactional success (Zucker, 1986).

CONCEPTUAL FRAMEWORK

Web site quality is important and widely studied in the e-commerce literature (Aladwani & Palvia, 2002; Koufaris, 2003). Liu and Arnett (2000) derive a framework from IS and marketing literature. They identify four factors that are critical to Web

site success in e-commerce: information and service quality, system use, playfulness, and system design quality. Wan (2000) empirically categorizes the features of Web sites that can be evaluated from the customer's perspective. Barnes and Vidgen (2001) contend that WebQual should be used to evaluate a Web site from a customer's point of view. We think that, from a customer's perspective, Web site quality can be addressed via four components: functionality, content, service, and attractiveness.

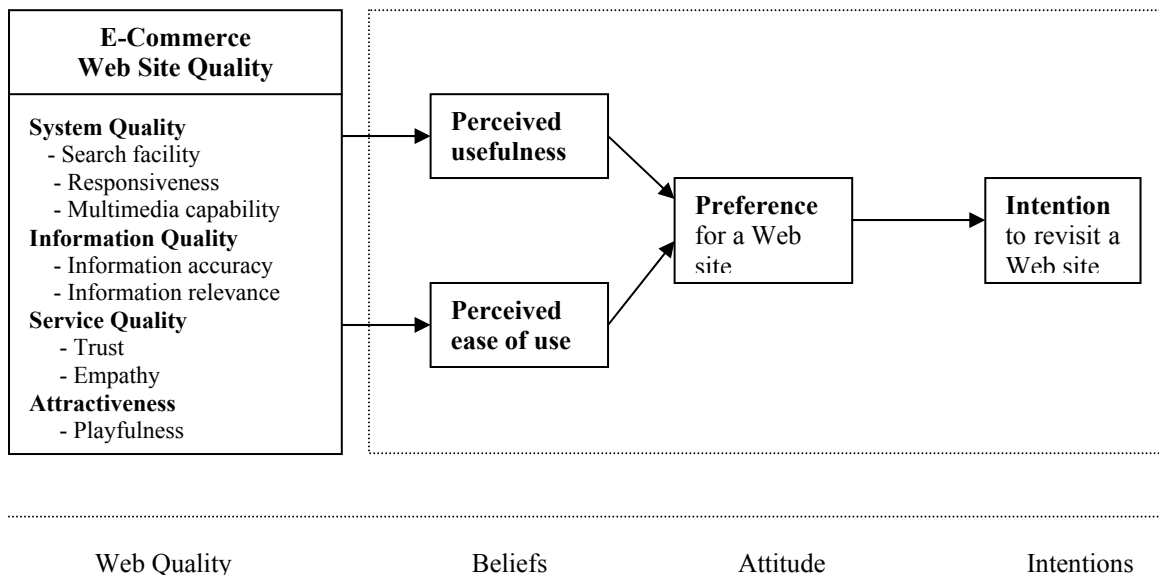


Figure 1: A Framework for Evaluating E-Commerce Web Site Quality

Figure 1 illustrates the framework being developed to relate Web site quality to customers' perceived usefulness and perceived ease of use, and further to customers' preference and intention to reuse the site. The framework is built upon TAM, SERVQUAL, and the concept of trust (Delone & McLean, 1992; Parasuraman *et al.*, 1985; Davis, 1989; Chen *et al.*, 2002). The customers' perceptions of a Web site are considered by applying TAM (Davis, 1989). TAM indicates that perceived usefulness and ease of use will influence an individual's attitude and intention to use a Web site, and customers' beliefs (i.e., perceived usefulness and ease of use) are affected by Web site quality (Davis, 1989; Eighmey & McCord, 1998; Lin & Lu, 2000; Chen *et al.*, 2002).

There are many discussions on beliefs, attitudes, and intentions based on TAM (i.e., the dotted-line box in Figure 1). For further discussion, please see Davis, 1989; Lederer *et al.*, 2000; Chen *et al.*, 2002; Lin & Lu, 2000. This paper only focuses on the identification and validation of the dimensions that capture Web site quality. Based on the previous literature review, four factors are identified: system quality, information quality, service quality, and attractiveness.

System Quality

System quality measures the functionality of a Web site: usability, availability, and response time. Specifically the system quality of a Web site can be assessed by search facility, responsiveness, and multi-media capability.

Search Facility. Search facility reflects the extent to which a tool or structure actually helps a Web site user to find information as perceived by the user (Huizingh, 2000). One of the problems in Web site design, whereby Web site users lose track of the context and are unsure of how to proceed, is called the navigation problem (Levene, 2001). For example, participants in a study report that they are disconcerted in cases where they have to scroll to locate the selection and add an item to the shopping cart (Bhatti *et al.*, 2000).

Responsiveness. Responsiveness is defined as the willingness to help online customers. It can be measured by the time taken before replying to a customer's inquiries (Watson *et al.*, 1998). Advances in the Internet and computer technology leave little excuse for any delay in responding (Wan, 2000). Wan (2000) considers the issue of responsiveness can be seen in at least two

ways: load time and search time. Search time mostly relies on the size of the database. Many pages are designed with being aware of the load time problems and have small pictorial illustrations. Amazon.com puts a sign of text-only on its homepage.

Multi-Media Capability. Multi-media capability refers to the non-verbal cues or features about the product and services that enhance the customer's feeling of preference for a Web site. Graphics, video clips, audio clips, and animation used to demonstrate products are examples of these features. These features can fulfill individual information needs, engender trust, and facilitate better learning experience (Chen, 2001). Non-text elements also enhance communication by helping visitors find or interpret the information presented. On the other hand, more multi-media enabled content takes more time to download. Designers must find a balance between an attractive design and providing information; this is not always easy (Huizingh, 2000).

Information Quality

Information quality captures the e-commerce content issues. "Content is king" is a well-known slogan (Huizingh, 2000). Providing information is the basic goal of a Web site (Bhatti *et al.*, 2000). Deciding what content to place on a Web site is extremely important. Content is represented by two constructs: information accuracy and relevance.

Information Accuracy. The most fundamental capability of a Web site is the presentation of information about products, services, people, events or ideas. By providing the inappropriate information on the site, companies can endanger their precious business images. It is, thus, imperative for companies to extend their attentions to the possible factors to enhance the information quality (Lin & Lu, 2000). The information on the Web site should be accurate, informative, and updated. The extent to which the information is accurate determines, among others, whether the promise is fulfilled. In Ducoffe's (1996) terminology, it is the informativeness that matters. Updated information means both updating existing content and adding new content to the site. For example, amazon.com states, in its side bar, that its list of 100 hot books is updated hourly.

Information Relevance. Information relevance refers to the extent to which the information on the Web site is related to the information needs of the customer. It is unlikely that a company wants to provide the same information to different groups of customers (Huizingh, 2000). Different parts of the Web site should be designed to meet the needs of different groups of customers. The potential customers of the Web site should be identified and their needs investigated (Clyde, 2000). Thus the needs of customers, as well as the subject coverage, have guided the development of different sections of the Web site. For example, the content of an automaker's Web site should include information related to its branches in different regions or countries and different models and features.

Service Quality

Service quality is an important dimension of IS success in the e-commerce environment where customer service is crucial (DeLone & McLean, 2003). Service quality measure the overall support delivered by the Web site. It includes trust and empathy. That is, the Web site should be secure and personalized (Lioacono *et al.*, 2002).

Trust. Trust refers to the extent to which customers believe the Web site is legal, ethical, and credible and is able to protect their privacy (Wan, 2000). According to a survey conducted by the European Electronic Messaging Association, more than 79% of respondents said that reliability is the top concern of e-commerce customers (Shankar, 1996). Once users perceive that reliability has been compromised, no purchase will be made. It is therefore crucial for systems designers to understand the effect of cumulative frustration, especially as it is typically in the later stages of interaction that users are likely to commit to a purchase (Bhatti *et al.*, 2000).

Empathy. Empathy refers to the extent to which a Web site provides caring, individualized information and attention to customers. Empathy is the presence of response mechanisms for improving the communication quality of Web sites. The nature of this dimension purports that two-way communication must exist. Features included in this dimension are email, chat rooms, bulletin boards, and mailing lists (Chen, 2001). The concept of empathy involves the exchange of individualized messages regardless of distance or time. The Internet is well suited in this regard where users can virtually visit any Web site at any time and from any place.

Attractiveness

Attractiveness consists of the issues of whether Web pages are fun to read and subjectively pleasing. Watson *et al.* (1998) coin the concept of "attractors." They argue the overall appeal is a key component of Web site quality. No matter how well the content is or how reliable and easy to search the Web site is, if users do not find the site appealing, they are not going to

spend much time there (Smith & Merchant, 2001). Chen (2001) examines the playfulness and how it affects the quality of Web site design. His finding suggests that playfulness is an influential factor to attract customers.

Playfulness. Playfulness includes the devices that attract the attention of Web site users with enjoyable constructs. Online games, software downloads, and Q&A are examples of these devices (Chen, 2001). Embedding playful features within the Web site not only differentiates a site from others, but also enhances the user's perceived level of satisfaction (Eighmey, 1997). Watson *et al.* (1998) also suggests that online users seek gratification in escape, entertainment, and interaction. This suggests that there is a need for Web designers to cultivate pleasure in site design by motivating customers to participate, promoting customer excitement and concentration, and including charming features to attract customers and to help them enjoy the visit (Liu & Arnett, 2000). This will lead to increased customer activities (Schmidt, 1996).

METHODOLOGY

In an effort to test empirically the suggested measures of Web site quality, it is important to find a real-world application domain. We choose online bookstores as the application domain and students as users because many students buy books using the Internet. Buying books over the internet is one of the early e-commerce applications that have matured to become relatively stable (Barnes & Vidgen, 2001). The bookstores chosen are Amazon.com, biggerbooks.com, and half.com. Students are mainly sophomore and junior who were taking the introductory computer applications class at the college level and are familiar with the internet. They are asked to assess the three Web sites and then complete the survey.

Because we focus our interest on e-commerce Web site design, we select participants who match a profile of Internet shoppers (e.g., students). It is essential that a homogeneous group of users be selected because users with different amounts of knowledge and experience of Web shopping have different expectations of Web site (Bouch & Sasse, 1999). The participants were given the same task series so that their path through the site was consistent. Participants were required to (1) go to the site and explore it first, (2) view books; (3) select a specific book that you want; (4) add the chosen book to their shopping cart; (5) view the contents of their shopping cart.

Respondents are asked to rate their perceptions of each of the sites using 1 to 7 scale which the anchor for 1 was "strongly disagree" and for 7 "strongly agree". In all, 213 completed and usable questionnaires were received from 71 students, each of who evaluated the three Web sites. The body of responses came from a range of university degrees. The characteristics of respondents are 54% female and 46% male; age 32% less than 20, 64% 20-30, 2% 30-40, and 2% more than 40; 4% married and 96% unmarried; income 68% less than 10K, 20% 10-20K, 11% 20-50K, and 1% greater than 50K.

RESULTS ANALYSIS

Items were purified as recommended by Churchill (1979) by examining the corrected item to total correlation (CITC) of each item with respect to its specific component in the construct. Then a factor analysis was conducted. The results are shown in Table 1. Seven factors emerge from the factor analysis with most factor loadings above 0.60. All items load on their respective factors except the construct of information relevance. It seems that information accuracy and information relevance are closely related for customers. Thus these two constructs load as one construct of information quality. The cumulative variance explained by all seven factors is 73.9%. After purification and factor analysis, Cronbach's alpha was calculated to assess reliability (see Table 1). Alpha values greater than 0.80 are very good for basic research (Nunnally, 1978). All the alphas are more than 0.80 except the construct of empathy, which is 0.71. Thus, this set of instruments is reliable.

The means and standard deviations for each item are also shown in Table 1. From the results of these three Web sites, the highest three constructs are information accuracy, responsiveness, and search facility. Two items of the trust construct (i.e., being secure and being reliable) and two items of the attractiveness construct (i.e., being appealing and promoting excitement) have high rating scores. The factor analysis results indicate that e-commerce websites should be designed to provide accurate information, reduce loading and searching time, make searching easier, and make the site secure because customers are most concerned with finding accurate information, searching fast, and placing order securely. A quality website should also be designed appealing.

Constructs		Items	Mean	S.d.	Factor Loadings							alpha
					1	2	3	4	5	6	7	
System Quality	Multimedia Capability	The Web site uses audio elements properly	4.12	1.32						.809		.80
		The Web site uses video elements properly	4.39	1.34						.735		
		The Web site uses animations/graphics properly	4.74	1.17						.668		
		The Web site uses multimedia features properly	4.69	1.40						.638		
	Search Facility	There is a clear indication of site's content	5.46	1.30			.786					.95
		The Web site has well-organized hyperlinks	5.28	1.21			.804					
		The structure of the site is logical to me	5.26	1.30			.785					
		Navigating the Web site is easy	5.35	1.27			.800					
		The Web site has explanation of how to use site	4.94	1.29			.673					
		I feel that is easy to find information on the Web site	5.34	1.27			.723					
	Responsiveness	The response time of the Web site is proper	5.41	1.24					.779			.94
		The searching is fast on the Web site	5.40	1.20					.773			
		The searching time is reasonable	5.40	1.17					.746			
		The loading time is reasonable	5.30	1.25					.688			
		The Web site is responsive to my inquiries	5.27	1.21					.520			
Information Quality	Information Accuracy	The Web site provides useful Information	5.16	1.19		.756						.94
		The Web site provides accurate information	5.17	1.16		.741						
		The Web site is informative	5.12	1.18		.740						
		The Web site provides updated information	5.02	1.19		.760						
		The Web site provides high quality information	5.22	1.21		.637						
		The Web site provides timely information	5.00	1.26		.631						
	Information Relevance	The information on the Web site is relevant to me	5.19	1.33		.546						
		I can find what I need in the Web site	4.68	1.39		.572						
Service Quality	Empathy	The Web site has interactive feedback mechanism between customer & business	4.73	1.56							.661	.71
		The Web site has personalized information	5.25	1.42							.640	
		The Web site is empathy to customers' problems	4.67	1.53							.580	
		The Web site is very concerned about my welfare	4.51	1.57							.711	
	Trust	I feel protected/safe when I use the site	4.99	1.46	.835							.96
		The Web site is secure	5.06	1.42	.830							
		The Web site is reliable	5.07	1.43	.809							
		I trust the Web site will not misuse my personal information	4.73	1.59	.759							
		The Web site conveys a sense of competencies	4.88	1.34	.757							
		The Web site satisfies ethics standards	4.92	1.38	.760							
		The Web site assures to solve my problem	4.76	1.34	.727							
		I feel very confident about the site	4.89	1.48	.738							
Attractiveness	Playfulness	The Web site is attractive/appealing	5.16	1.32				.640				.92
		The Web site promotes customer excitement	5.15	1.32				.675				
		The Web site motivates customers to feel participation	4.83	1.33				.732				
		The Web site provides attractors such as online game/cartoons	4.81	1.30				.723				
		The Web site is fun	4.25	1.40				.758				
		The Web site is entertaining	4.21	1.35				.753				
Eigenvalue					6.99	5.54	5.37	4.19	3.87	2.81	2.29	
% of variance					16.6	13.2	12.8	10.0	9.2	6.7	5.4	
Cumulative % of variance					16.6	29.8	42.6	52.6	61.8	68.5	73.9	

Table 1. Constructs, Items, Means, Standard Deviations, Factor Loadings, and Reliabilities

SUMMARY AND IMPLICATIONS

This paper identifies and pools together a set of factors capturing the quality of an e-commerce Web site, which in turn affects customers' perceptions, preferences, and intentions. A set of reliable instruments for Web site quality has been developed and empirically validated. These factors and instruments have significant practical meaning for e-commerce Web designers and Web managers.

An attractive e-commerce Web site starts with good content. The information provided in the Web site has to be accurate, informative, updated, and relevant to customers' needs. A good site not only contains sufficient information, but also is user

friendly. In another words, the web site must have a good functionality. The site should have a search facility help users to maintain a mental map of the site, provide a two-way communications between the users and the site, and respond to the users' search and browse quickly.

A Web site needs to provide a good service to customers. Not only does it need to protect the purchasers ethically and legally (i.e., trust), but also it needs to provide caring and individualized information and attention to customers (i.e., empathy). Besides, a superior e-commerce Web site also has an emotional dimension – attractiveness, which brings a human touch. It is a significant factor to attract visitors to the site.

In designing an e-commerce Web site, a more effective approach, which has been used in a limited way on the Web, is to focus on customers' perceptions of a Web site (Katz et al., 1991; Weinberg, 2000). The physical design elements (i.e., type of information, links, layout, appearance, etc.) are important but insufficient; it is the customers' perception of a Web site makes differences. For example, if a Web user perceives the loading time of a site to be intolerable, then the Web user will direct the Web-browser elsewhere; and potentially, not purchase any of the products. Instead, in circumstances where feedback is provided, the tolerance of delay is significantly higher (e.g., an icon that indicates the proportion of information that has been loaded appears near the bottom of a Web-browser).

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